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Wolf (R.) Astronomische Mittheilungen. December 1888. 8vo. [*Zürich*]. Dr. Wolf.

Photograph of the portrait of John Evelyn, F.R.S., in the possession of the Royal Society. Dr. Frankland, F.R.S.

April 11, 1889.

Professor G. G. STOKES, D.C.L., President, in the Chair.

The Presents received were laid on the table, and thanks ordered for them.

The Bakerian Lecture was delivered as follows:—

BAKERIAN LECTURE.—"A Magnetic Survey of the British Isles for the Epoch January 1, 1886." By A. W. RÜCKER, M.A., F.R.S., and T. E. THORPE, B.Sc., Ph.D., F.R.S. Received (in abstract) April 11, 1889.

(Abstract.)

Two magnetic surveys of the British Isles have been made previous to that of which an account is given in this paper. The necessary observations were taken between the years 1834–38 and 1857–62, and the results were reduced to the epoch 1842·5 by Sir E. Sabine ('Phil. Trans.,' 1870, p. 265). The stations in these were very irregularly distributed over the area under investigation, the declination was determined at but few places, and the force in the earlier survey was only determined relatively to London.

In the five years 1884–88, both inclusive, the authors have made an

exhaustive survey of the United Kingdom. They have observed at 200 principal and a number of secondary stations, and at all the principal stations, except three or four, all the magnetic elements have been determined.

The two sets of instruments employed have been carefully compared with each other at the Kew Observatory in 1884, 1886, and 1887, and are in remarkably good accord. All the observations were made by the authors except the dip observations at eight stations in Scotland, for which they have to thank Mr. A. P. Laurie, Fellow of King's College, Cambridge.

The chronometers were frequently compared with Greenwich by means of the 10 A.M. time signal, for leave to receive which the authors are much indebted to the good offices of Mr. Preece, F.R.S.

The probable errors of the observations are as follows:—

Declination	± 0′·699
Horizontal force	± 0·00028 (M.V.)
Dip	± 0′·51

In this computation, only declination observations which are in all respects independent are included. The horizontal force observations are also as independent as is possible for nearly simultaneous observations, and the dips compared are those taken with the two needles.

The authors propose the name *isomagnetics* for the class of curves which are drawn through points at which the values of one of the magnetic elements are constant, and in which isogonals, isoclinals, &c., are included.

To determine the form of the isomagnetics, they divided the area of the survey into nine overlapping districts, and found for each a linear formula which connected the value of the element with the latitude and longitude. By means of this formula they calculated the value of the element at points where the lines of longitude corresponding to whole degrees east or west of Greenwich intersect lines of latitude which correspond to half degrees. Where several districts overlap, the mean value was taken. From the values thus obtained at a series of points regularly distributed all over the country, the isomagnetics were approximately determined. The forms of these curves were slightly irregular, and equations were framed to represent smooth curves which passed through their mean directions. These were the equations to the terrestrial or undisturbed isomagnetics.

These are compared with those obtained in the earlier surveys, and the secular change is fully discussed.

The calculated values of the elements are then obtained for every station, and by comparing these with the observed values, the magni-

tude and direction of the disturbing force at each station was determined.

It was found that the Malvern Hills attract the north pole of the needle strongly.

The well-known fact that the difference of the declination at Kew and Greenwich is much greater than the difference of longitude will explain, is found to be connected with a widespread regional magnetic disturbance within the area of which these observatories lie.

Several methods of argument all point to the conclusion that the centre of this disturbance lies between Windsor and Reading, and a little to the north and east of the latter town. Towards this point all the calculated disturbing forces in the neighbourhood converge.

The authors adopt, as a working hypothesis, the view that this attraction is due to the same cause as that observed at the Malverns, viz., the presence of igneous rocks, and they prove that the range of the disturbance extends from Kenilworth to the Channel, and from Salisbury to the North Sea, a total area of about 10,000 square miles.

As the centre is approached the excess of the observed downward vertical force above that given by calculation increases, and it reaches a maximum at Reading close to the point which a study of the horizontal forces had indicated as the centre.

Extending the same method to the rest of the country, though this has not been studied by them in the same detail as south-eastern England, the authors prove (1) that the results obtained on re-visiting the same station indicate that even in disturbed districts, the direction of the disturbing force can in general be determined by a single set of observations to within 15°, and in most cases to within a much smaller limit; (2) that the directions of the disturbing forces were the same when Mr. Welsh surveyed Scotland in 1857 as they are now; (3) that the horizontal disturbing forces tend towards districts in which the vertical disturbing force is a maximum; (4) that certain regions in which crystalline rocks occur display a marked attraction on the needle; (5) that in certain other regions, and notably in lines running respectively from London to the South Wales coal-field and from the Lincolnshire Wolds to the Lake District, though no crystalline rocks appear on the surface, magnetic attractions, similar to that observed near Reading, are in play, which indicate the existence of crystalline rocks at no great depth; (6) that there are in Great Britain five principal regions of the two kinds referred to in (4) and (5), towards which the horizontal disturbing forces act. Their positions may be defined approximately by means of the following lines, which pass through their central parts, viz., (α) the line of the Caledonian Canal; (β) a line somewhat to the west of the basaltic masses in the Western Isles; (γ) a line passing through the Scotch coal-field, in which crystalline basaltic rocks occur; (δ) a line certainly parallel to,

and possibly coincident with, that along which the Jurassic and Liassic strata thin out very rapidly in south-east Yorkshire, and passing thence towards the Cumberland lakes; (*e*) a line the general direction of which coincides with that of the Palæozoic ridge between London and the South Wales coal-field.

The following Paper was read:—

I. "Experiments on the Nutritive Value of Wheat Meal." By A. WYNTER BLYTH. Communicated by Dr. LAUDER BRUNTON, F.R.S. Received March 30, 1889.

A physician, who may be designated as A, undertook to live for twenty-eight days on distilled water and whole meal. Each day a certain quantity of the meal was ground by himself, weighed, and made either into cakes or porridge by means of distilled water.

The excreta were forwarded to me for analysis.

The experiment may be divided into three stages:—(1) A period of eight days, during which the insufficient quantity of 16 ozs. (453·59 grams) of whole meal was taken; (2) a period of fourteen days, during which 20 ozs. (566·98 grams) of whole meal were taken; (3) a period of seven days during which 28 ozs. (793·77 grams) of whole meal were taken.

General Physiological Effects.

The condition of A was carefully tested by Mr. Randall at Mr. Francis Galton's laboratory, before and during these periods.

Condition before the experiment:—

Weight in clothing	129 lbs.
Strength of squeeze (right hand)	67 „
„ (left hand)	60 „
Breathing capacity	198 cub. in.
Distance of reading diamond numerals (right eye)	9 inches.
Distance of reading diamond numerals (left eye)	7 „
Snellen's type, read at 20 feet distance	D 60
Highest audible note (by whistle)	19,000 vib.
Reaction time (sound)	15*
„ (sight)	15*
Error in dividing wire in half	0 p. c.
„ „ in thirds	0 p. c.
Error in degrees in estimating angle 90°	0°
„ „ „ 60°	11°

* Reaction time for sound and sight in hundredths of a second.